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ABSTRACT

This report summarizes the roundtable on information technology which brought together leaders from business, government, the non-profit sector, and academia to explore the use of complex adaptive systems as a model for determining information technology's role in both the workplace and diverse societal settings. Topics covered in this document are: new perspectives for understanding information technology; information technology in the workplace; information technology and its affects on democratic values and culture; and constructing a vision for information technology. Also included is a paper developed from the roundtable: "Towards Informed Participation: Six Scenarios in Search of Democracy in the Electronic Age" (John Seely Brown, Paul Duguid, and Susan Haviland). A list of conference participants and the Communications and Society Program Statement are appended. (JLB)

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Communications and Society

The Promise and Perils of Emerging Information Technologies

A Report on The Second Annual Roundtable on Information Technology

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FORUM REPORT

THE PROMISE AND PERILS OF EMERGING INFORMATION TECHNOLOGIES

A Report of
The Second Annual Roundtable on Information Technlogy

Aspen, Colorado
August 4–8, 1993

by
David Bollier
Rapporteur

with a special paper

TOWARDS INFORMED PARTICIPATION:
Six Scenarios in Search of Democracy in the Electronic Age

by
John Seely Brown, Paul Duguid and Susan Haviland

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FOREWORD

The world increasingly accepts the notion that new forces of information creation, transfer and consumption will strongly affect one's personal, social and organizational landscapes. Information, and its contextualized ancestors and progeny, knowledge and wisdom, are new currencies in the worlds of commerce, citizenship and even homelife.

Certainly the recent activities of The Aspen Institute's Communications and Society Program reflect this trend, and no more so than in its new series of annual Roundtables on Information Technology. Begun in 1992, this project brings together visionaries and leaders in the information world with entrepreneurs, political and other leaders to explore new notions of how information technology will alter the way people work, form communities and govern themselves.

The first Roundtable waded into these waters, discussed new paradigms for thinking about the subject, and exchanged points of view on the significance of information technologies in causing and solving problems both in the workplace and in the broader society. The Forum Report, *"The Information Evolution: How New Information Technologies are Spurring Complex Patterns of Change,"* describes how that conference was taken with the notion of self-organizing and co-evolving complex adaptive systems as a model for addressing many of the current issues. The response to that volume has been extraordinary.

The second annual Roundtable, reported here, sought to probe the concepts introduced in 1992—essentially, the applicability of complex adaptive systems approaches to information technology's role in both the workplace and diverse societal settings. The Conference, held on The Aspen Institute campus in Aspen Colorado, August 5–8, 1993, was entitled, "New Paradigms for a New Democracy."

David Bollier's excellent report of the Roundtable does not try to recount each participant's contribution to the four days of discussions. Rather,

he brings together the strains of discussion which fit coherently into this year's themes. Bollier is aided by some of the remarkable "mind maps" created at the conference in real time by Sherrin Bennett, president of Interactive Learning Systems.

To spark discussion at the conference, the Institute commissioned three scenarios of life in the future, which would highlight the role of information technology in the workplace, democratic institutions and the home environment. We want to take this opportunity to thank Barry Berkus, principal of Berkus Group Architects, Santa Barbara; John Seely Brown, Vice President, Chief Scientist and Director of the Palo Alto Research Center, Xerox Corporation; and Professor Thomas Malone, Director of the Center for Coordination Science at MIT, for their helpful contributions. Aspects of these scenarios are described in the ensuing report. John Seely Brown and his associates, John Duguid and Susan Haviland, went beyond the creation of scenarios to assemble a coherent theory of "Informed Participation." This approach captivated much of the discussion of this year's sessions; and accordingly, we have reprinted their piece as an appendix to this report.

Once again, we have two corporations to thank for their generous sponsorship of this Roundtable, SHL Systemhouse, Inc., and Oracle USA. As in the first year, we want to give special recognition to Jerry Murdock, principal of the Aspen Technology Group (a private organization) and co-founder of the Roundtable, for his tireless energy in helping to organize, conceptualize and effectuate this project. We also want to acknowledge Katharina Kopp, Program Associate of the Communications and Society Program, for planning and coordinating the conference, and for helping in the editing and production of this report; and Tran Vu, Prógram Assistant, for her help in coordinating the conference.

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THE PROMISE AND PERILS OF EMERGING INFORMATION TECHNOLOGIES

I. INTRODUCTION

As a dizzying assortment of information technologies insinuate themselves into workplaces, households and civic and cultural spheres, they are slowly but profoundly changing the way in which Americans live. To be sure, it is an eclectic electronic revolution with dozens of shifting, irregular fronts, some tightly interconnected, others still emerging on the frontiers of the imagination. The technologies driving some of the most significant changes include networked offices and mobile communications, which are transforming the ways in which workforces communicate and businesses compete; E-mail and the Internet, which are creating thousands of new "virtual communities"; the emerging digital fiber optics "information highway," which promises to transform historically separate electronic media (television, telephony, computing, data transmission) into a single, integrated multimedia environment; and interactive media and computer simulations, which offer provocative new ways of learning about the world.

Perhaps the biggest challenge posed by this vast, helter-skelter transformation is *understanding* the evolutionary dynamics and impact of information technology over the long term. Can we devise useful investment criteria, organizational structures, marketplace rules and government policies to guide the development and use of the new systems? A fear lurks in many people's hearts that perhaps we are captives of these technologies—that a market-driven determinism will confound our ability to guide these new tools in responsible directions. On the other hand, many theorists point to the many innovative ways that information technology can help invigorate communities, organizations and civic culture.

To take stock of these concerns, The Aspen Institute Communications and Society Program convened its second annual Roundtable on Information Technology on August 4–8, 1993, in Aspen, Colorado. Twenty-five participants with a remarkable diversity of perspectives and firsthand expertise sought to identify "New Paradigms for a New Democracy"—the title of the conference. The group included top executives of leading information technology businesses in the United States, Europe, Russia and the Far East; investment managers specializing in information technologies; leading sci-

entists and academics who study the design and deployment of information technologies; preeminent government officials and policy experts from the United States and Europe; and journalists who report on various facets of the information revolution.

A central premise of the conference was that the intellectual and regulatory paradigms for understanding the "old media"—chiefly broadcasting and telephones—are no longer adequate in the 1990s. The old media generally required federal regulation to provide for the "public interest, convenience and necessity." The avalanche of new information technologies introduced since the 1970s, however—computers, video cassette recorders, cable television, satellite dishes, cellular telephones, and fiber optics transmission, to name a few—are veritable creatures of marketplace competition, at least when compared to the old media.

The fact of a new market-based paradigm does not end the inquiry into these technologies, however; it only opens up a new one. Much remains unknown about how people will embrace and use various new information technologies in commercial, civic and personal contexts. Furthermore, if only to ensure a fair and orderly marketplace and a measure of social equity, government will necessarily need to play some role in overseeing the evolution of new technologies. The precise extent and nature of the government's role, of course, will remain an inherently contestable, political matter.

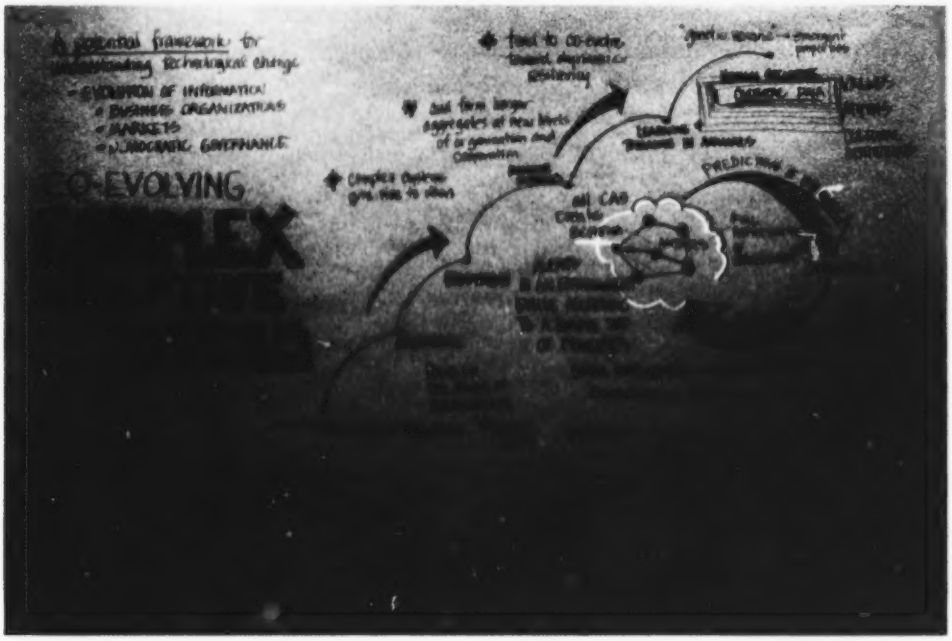
Yet the *character* of government telecommunications and information policy surely must change. If the past was based upon managing and regulating scarcity, as Professor Jay Blumler has written, the future must be a matter of protecting and promoting potential. A new set of paradigms are urgently needed to help understand and intelligently guide development of the new technologies.

The first annual Aspen Institute Roundtable, in 1992, had found many compelling insights in theories of "complex adaptive systems." While participants in this second Aspen Institute Roundtable generally agreed that the principles of complex systems have great explanatory power, they offered many new elaborations and caveats to the previous year's discussion. (For more on the 1992 conference, see The Aspen Institute report, *"The Information Evolution: How New Information Technologies are Spurring Complex Patterns of Change."*)

II. NEW PERSPECTIVES FOR UNDERSTANDING INFORMATION TECHNOLOGY

A. Complex Adaptive Systems and Information Technology

The burgeoning contemporary literature on complex adaptive systems had its origins in cybernetics and general systems theory in the 1960s. While examining large, complex systems, scientists sought to identify a simple set of principles that could help explain complexity that was other-



wise unfathomable. The still-emerging result of this work is a branch of scientific inquiry known as "complexity theory," which has significant things to say about the functioning of complex systems in biology, economics, culture, the physical sciences, computation, and other realms. The focal point of complexity theory is not *things*, as conceived by Newtonian physics, but *relationships* among agents as they emerge over time in a complex environment that is itself changing, or co-evolving, in response to various agents. "There was a time when it was thought that intelligence was located in a point, or locus," explained John Clippinger, Director of Digital Media for Coopers & Lybrand. "But now it is apparent that intelligence is very distributed. So we can see complexity emerge from a set of relatively simple systems."

Extremely simple rules can generate complexity that is "surprising, non-random and non-repeating," said John Hiles, Vice President and General Manager of the Business Simulation Division of MAXIS, a computer software company that specializes in computer simulations. For example, Craig Reynolds of the Symbolics Corporation in Los Angeles was attempting to make a series of small objects on a computer screen mimic a flock of birds in flight. He discovered that three simple rules embedded in each object could generate genuine "flocking" behavior; a complex apparatus of rules was not necessary.

Some fundamental characteristics of complex adaptive systems, said William H. Janeway, Managing Director of E.M. Warburg, Pincus and Co., Inc., are a sensitivity to initial conditions in an environment; a variety of feedback loops that help the system learn or evolve, thus improving its chances of survival in a competitive environment; an environment that is

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itself evolving in a highly non-linear, dynamic manner; and a unique path of historical evolution resulting from the foregoing factors. To help them survive and adapt, complex systems rely upon highly compressed "schema" which provide a predictive model or theory about the world and how a complex system should function. Examples of schema include DNA in biological organisms, myths in cultural systems, and competitive strategies in business enterprises. [Two recent books that provide good overviews of complexity theory are Stuart A. Kauffman's *The Origins of Order: Self-Organization and Selection in Evolution* (Oxford University Press, 1993), and M. Mitchell Waldrop's *Complexity* (Simon & Schuster, 1993).]

Despite obvious Darwinian implications, complexity theory does not imply the desirability of a libertarian free-for-all, warned John Clippinger, Director of Digital Media for Coopers and Lybrand, the management consulting firm. The overall health of a given complex system—be it an organism, an economy or a culture—requires certain *constraints* to help ensure an equilibrium among its component parts, he said. Thus societies must uphold certain moral and social values, organisms must regulate a certain balance among its internal agents, and so forth. (On the other hand, a complex system whose agents are too constrained in their interrelationships with each other will be rigid, non-adaptive and less likely to survive.) Complex systems that involve human beings, furthermore, are capable of being intentionally modified. Unlike the apparent determinism of biological or physical systems, human beings can more readily change complex systems by applying their values, reason and historical experience. For this reason, William Janeway cautioned, we must be careful not to misapply complexity theory, replicating a previous generation's callous use of Herbert Spencer's social Darwinism.

Many information theorists have enthusiastically embraced complexity theory because it provides a richer, more dynamic model for understanding the actual functioning of the world. Unlike Newtonian physics or neoclassical economics, complexity theory helps explain unique historical contingencies: why one path of development (in an organism, a business, a marketplace, a political system) emerges instead of another, for example. Equally important, complexity theory can give a crudely accurate overview of the whole, which can supplement a highly detailed but narrow portrait of component parts. Conventional economics excels at the latter enterprise, said John Hiles of MAXIS, by presuming a set of rigid theoretical conditions, such as utility-maximizing individuals making purely rational decisions based on free information, and so forth. "A lot of important information gets left out that way," Hiles pointed out. "Even though it may be inconvenient for us to describe certain things that are fuzzy or involve values, those factors are very important if you are going to construct an accurate picture of the whole. You can't exclude controversy just because it doesn't fit in your super-computer model."

For those on the frontiers of information theory, the principles of complex adaptive systems are important because they provide a new, if

imperfect, vocabulary for talking about the evolutionary dynamics of complex systems. Complexity theory introduces entirely new concepts—such as "fitness landscapes" and "complementarities,"—that can help elucidate otherwise puzzling natural phenomena. Although itself still evolving, complexity theory represents a new intellectual synthesis and way of looking at things. Because of its sweeping and fundamentally different analysis towards natural phenomena, complexity theory implies a new metaphysics as well.

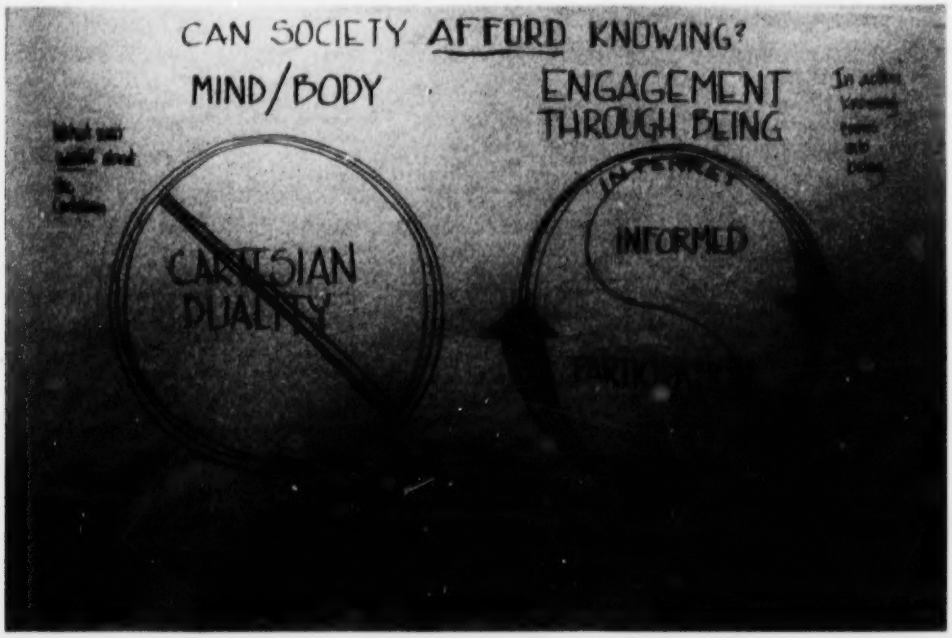
Many theorists are starting to apply the concepts of complexity theory to the functioning of the "knowledge economy"—producing intriguing results. For example, turning the classic economics concept of "diminishing returns" on its head, economist Brian Arthur has developed the idea of "increasing economic returns." That is, positive feedback can be observed to drive one of many competing technologies to dominance, resulting in the phenomenon of "technology lock-ins" that stymie the development of superior technology.

Complexity theory may also have profound implications for government policymaking. Instead of trying to achieve a given outcome, policymaking inspired by complexity theory instead focuses on *the process* by which a given complex system (a marketplace, a technology) will evolve over time. Policy does not specify and promote rigid goals; it seeks to affect the general *conditions* in a marketplace or business operation, which in turn will produce a spectrum of desired results over time.

B. Enhancing "Implicit Knowledge" and "Informed Participation"

In deploying information technology, one's philosophical assumptions about how the world works can be critical, said John Seely Brown, Corporate Vice President, Chief Scientist and Director of the Xerox Corporation's Palo Alto Research Center. Western culture and business management practices conceive the world through sets of Cartesian dualities, said Brown—mind and body, thinking and doing, management and workers. These presumed dichotomies encourage people to conceive of "information" as "knowledge packaged into little tidbits that get passed down little conduits into people's heads." In the Cartesian sense that generally prevails in our society, "knowledge" is improved the more that it is abstracted, objectified and decontextualized.

Informed by the philosophy of Martin Heidegger, Brown argued that "knowledge" is really a more complex and subtle matter. Because knowledge is acquired only by interacting with the world and people, it is better described, philosophically, as "knowing in action." "There is a merge between being informed and participating in the world," Brown noted. "You can't really be informed unless you participate; and you can't really meaningfully participate unless you're informed." Knowledge therefore requires *"informed participation"*—an interactive cycle of "engagement through being."



Understanding knowledge in this fashion immediately introduces a more dynamic, evolutionary component. One action leads to, and evokes, another situation, which provokes another set of responses, then another and yet another—along the lines of improvisational theater. Human knowledge accrues through a fluid, interactive process in which new interpretations give rise to new actions, and vice-versa.

Furthermore, many of the new actions and interpretations draw upon an *implicit knowledge* that may or may not be consciously known or articulated. Brown noted an important distinction between "implicit knowledge" which, while fully operative, is not generally articulated, and "explicit knowledge," consisting of the overt, cognitive "facts" that people communicate with each other. The explicit "concepts" that people take for "knowledge," Brown said, "are only the end result of an elaborate process in which they are refined out of practice." He further explained:

> *Concepts are a sort of short-hand encoding of social practice. This means that they can only be decoded by people who, through their own practice, have developed appropriate decoding skills. Thus to promote knowing through information, you must simultaneously promote action through participation.*

Dissecting the nature of knowledge in this manner helps explain the "mystery" of how workers "know" more than managers know that they know, said Brown. "It's not that workers have more (explicit) knowledge. It's that in action, they *know*. In a given situation, in action, knowledge comes into

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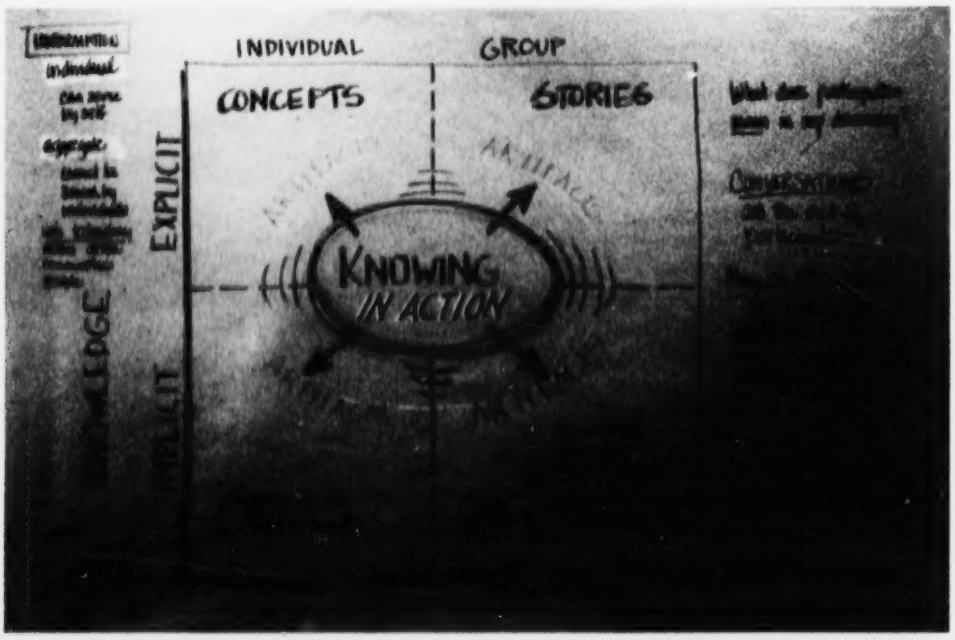

being." The real challenge, then, is for societies and businesses and cultures to allow and facilitate (or in Brown's word, to "afford") "knowing in action."

This alternative philosophical way of understanding knowledge—or "knowing in action"—has profound implications for the effective use of information technology. If "informed participation" is so vital, then information technology should not be used simply to transmit and receive abstract bits of decontextualized knowledge, so that people can "get knowledge." Rather, the technology should be used to create new business and social contexts that foster "knowing in action" and "informed participation." Management systems and technology should enable people to interact more effectively and meaningfully with each other, he said. It should be tailored to, and complement, a given human context and social community.

To illustrate the difference between the simple transmission of "knowledge"—a static notion of "knowing"—and the more dynamic "knowing in action," Brown cited the differences between a conventional talk show and a talk show which invites viewers/listeners to call in. "An interactive talk show sets a context or situation which affords your thinking about something," said Brown. "The activity of an interactive show evokes new possibilities [of thought and action], even if you don't actively participate." The failure to understand the deeper, more fluid, implicit dynamics of knowledge-acquisition can be seen in business process re-engineering, said Brown. Attempts to restructure business organizations to make them more efficient typically focus on "explicit processes of the group," said Brown, instead of on the "tacit knowledge that exists in the 'social mind

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in action'." This is actually where core competencies and work practices reside, he noted.

This philosophical model for understanding knowledge-acquisition and the communication of information holds at least three primary lessons for anyone designing or deploying information systems for groups of people:

1. Focus more on relationships than on things. Information technology can and should change relationships among people, said Brown; that is where its chief value lies. Information technology that changes the nature of relationships can change the fundamental features of a given complex system.

2. Honor "emergent behavior." One important lesson of complex adaptive systems is that "genetic variance"—or the pluralism of schema in a given system—is important for that system's adaptability. Therefore, information technology should allow the emergence of competing agents (or models or schema) and enhance their interrelationships. In our democracy, the technology should be used to honor the Jeffersonian virtues (freedoms of speech, press and assembly) which Jefferson recognized keep a society vital and resilient over time.

3. Under-design systems in order to let new truths emerge. Designing a minimalist system that honors a "genetic variance" of agents will facilitate autonomous interactions among those agents. "Don't set forth some *a priori* notion of truth or design in totality (which requires an infinite intelligence in any case)," said Brown. "Use intelligence to under-design a system and assist the emergence of new ideas." The brilliant logic of an under-designed information system is well-illustrated by the constitutional and cultural principles espoused by Thomas Jefferson, a preeminent "information architect," said Brown.

III. INFORMATION TECHNOLOGY IN THE WORKPLACE

To suggest how the economy and work life might be changed by information technology in the future, Professor Thomas Malone, Director of the Center for Coordination Science at the Massachusetts Institute of Technology, presented an imaginary scenario describing a day in the life of an automotive design engineer. The scenario was offered not as a forecast nor as a necessarily desirable future, but as a provocative depiction of what the future could plausibly look like, in the year 2010, given current trends.

Information technologies increase the desirability of using markets to organize relationships, explained Malone, because they can keep track of the data and interconnections needed to make markets perform more efficiently. In constructing a scenario of the future, then, Malone wanted to explore what happens if this trend is taken to an extreme. What happens if all work

relationships between people are mediated by transactions in a marketplace, and every individual functions as a company (or multiple companies) working in constantly shifting teams, coalitions and joint ventures? Is this sort of future feasible and desirable—or not?

A. The Workplace Scenario by Professor Malone

Malone's scenario describes a world seventeen years from now in which advanced information technologies, operating on a global free market, are used to coordinate complex technological design. The story features an electrical engineer, Joan, who specializes in the design of electrical components for motor vehicles. Working as a one-person company, Joan is part of a small fraternity of independent automotive designers who alternately compete and cooperate on a project-by-project basis in a vast global market. Automotive design in this mythical future world is organized through loose "adhocracies," or networked organizations, rather than through conventional corporate hierarchies of long-term, full-time employees. This work arrangement is made possible by future information technologies, which permit easy, ubiquitous, cost-efficient interconnections among far-flung enterpreneurs in constantly evolving markets.

Malone's scenario describes how Joan works alone in an office near her home, collaborating with colleagues around the world via information technology. Her current project involves the design of a headlight for "Camelot," an ad hoc group of engineers designing electronic subsystems for the Beijing Motors Mini-Car Project. One day Joan learns from her computer "agents," a software feature, that her equity holdings in Camelot had declined in value by 97 percent overnight. It turned out that the battery designer on her project had found another set of electrical engineers, in London and elsewhere, who could design a more energy-efficient electrical subsystem, using another headlight designer who, additionally, could complete the job more quickly than Joan. This new group of engineer-entrepreneurs immediately formed a new venture to perform the electrical design work for Beijing Motors. Hence the decline of Joan's shares and the end of her participation in one project. Beijing Motors acquired the cheapest, most innovative design results; the best design team prevailed; and for Joan, tomorrow would be another day.

B. Reactions to the Workplace Scenario

Malone's fictional scenario provoked a spectrum of reactions. Ray Lane, President of Oracle USA, noted that Malone's scenario is very similar to how efficient markets operate today (e.g., secondary mortgage market, Wall Street, global trading, etc.). Indeed, as vertical integration in many industries breaks down—resulting in greater outsourcing through the market and hence greater efficiencies—the hyper-competitive world depicted by Malone is increasingly common, said Lane. "I think this world makes a lot of sense," he said. "In many ways it makes more sense than the

world we have today." Lane worried, however, that if too many professional workers compete as freelance entrepreneurs, there could be a loss of the creative spirit of work teams, which has its own efficiency value in accomplishing given objectives.

Johnny Moo, Group Management Director of CSA Holdings Ltd. of Singapore, believes that Malone's scenario is chiefly applicable to a highly professional elite, and not to the great mass of workers who do not have specialized expertise or the ability to interact in such a manner. In Singapore, for example, despite widespread computerization, approximately one-quarter of the workforce cannot keep pace with new information technologies, said Moo. For such a workforce, Malone's scenario would either be implausible or highly disruptive, he asserted.

Malone's scenario also runs up against two tenacious problems that occur in attempts to achieve greater efficiencies through the marketplace, warned William H. Janeway of E.M. Warburg, Pincus and Co., Inc. The first problem is that of "false trading": contractual deals may not in fact be based on perfect foresight, as neoclassical microeconomic theory assumes. To enhance efficient pricing, therefore, many mainstream economists such as Kenneth Arrow point out the need for futures markets and, indeed, *contingent* futures markets that can take account of differing prognostications. But even these elaborations of neoclassical microeconomic efficiency theory cannot compensate for the messy imperfections of the real world, said Janeway.

A second problem with Malone's scenario, said Janeway, is that the capital base for such business ventures brings together two separate types of capital: bricks-and-mortar physical assets and intangible intellectual assets (the specialized knowledge for achieving given technological results). While the value of intellectual assets can be readily re-negotiated, as Malone's scenario suggests, the bricks-and-mortar assets are inextricably bound up with the intellectual assets, through a contract. As a result, it can be difficult or impossible to trade or liquidate intellectual assets rapidly, especially since the financing for fixed assets is generally based upon anticipated cash flows over a given term of years; such long-term commitments are not easily shed.

Janeway's central point: In the real world, equity interests cannot be constantly re-valued and re-traded to achieve theoretical efficiencies. Moreover, such a fluid, market-driven professional milieu does not provide a stable incubator of learning and mentoring for the next generation of professionals.

Esther Dyson, President of EDventure Holdings Inc. and Editor of Release 1.0, agreed, pointing out that there are many hidden costs in Malone's work scenario. "Learning is inherently a long-term process," she noted, yet Malone's market-driven work arrangements do not provide real incentives to learn the "implicit knowledge" that any profession entails. Moreover, she said, the costs of constantly assessing alternatives, negotiating relationships and dealing with uncertainties becomes "exponentially large as time dimin-

ishes." Apart from these realities is a basic human fact: most people *want* stable and enduring work relationships, she pointed out. For all sorts of personal reasons, people do not generally jettison work relationships for incremental economic advantages elsewhere.

For John Clippinger, Director of Digital Media at Coopers & Lybrand, the Malone work scenario is "a nightmare" because it ignores the fact that many important human relationships are not transactional in nature. A "learning system"—be it a business organization, a society or a biological organism—has a critical need for memory and feedback. Such capabilities help a system perpetuate itself and co-evolve successfully with a changing environment. If such functions are lost—by consigning them to transactional market relationships that do not honor long-term commitment, for example—then the system may die. This may be true, Malone agreed, but market transactions often do foster long-term relationships. There are circumstances, for example, when it is more important to protect one's reputation with business partners or customers than it is to maximize short-term profit.

Still, Clippinger continued, "There is a presumption [in conventional economic thought] that if we have transactionally efficient systems, somehow leadership, social coherence and the relationships among people will evolve. But many tribal societies place a higher premium on maintaining the relationships that define the group," he said. That is how they enhance leadership, social equity, group coherence and ecological sustainability. One way that this is achieved in some tribal societies, said Clippinger, is through potlach ceremonies, which uses gift-giving exchanges to enrich the sense of mutual support and obligation among tribe members.

Morton H. Meyerson, Chairman and Chief Executive Officer of Perot Systems Corporation, worried that leadership and accountability would suffer in Malone's fictional world of extreme atomistic competition. "How would you like to fly on an airline which [is engineered by] 40,000 companies?" he asked rhetorically. "I wouldn't. I don't think that the market would provide the responsibility. . . . I really have trouble with putting economic responsibility down at individual levels [as in Malone's scenario], because I believe it is a sub-optimal use of people because it works against the cause. I believe in teams and team efforts more than individual-based metrics." H. Brian Thompson, Chairman and Chief Executive Officer of LCI International, agreed that extreme individualism "risks a lack of accountability" for poor performance while also failing to help generate visionary business leadership.

For these reasons, business organizations in the future will be "thin-skinned," in Morton Meyerson's words: they will allow parts of the company to own and control businesses on the outside of the company. Such arrangements will jointly serve the goals of efficiency, accountability and personal satisfaction. To honor these values, the optimally sized work units should perhaps be "small alliances of individuals—'mini-tribes'—that stay together for a finite, useful life," said Meyerson. A more fragmented world of atomistic

competition would not serve "a basic human need for tribalism, with mores, taboos and identity," he warned.

Professor Malone agreed that the optimum size of market units is probably small teams, rather than individuals, because that would provide the best of both worlds: the mutual support and creativity of a team with the personal initiative and responsibility of the individual. Malone also speculated that perhaps market relationships could be inscribed within "tribes"—i.e., participation in a given market would require membership in the tribe.

But there may be *no* single optimal size for business entities, said John Clippinger of Coopers & Lybrand, if we are to believe complexity theorist/economist Brian Arthur. Arthur recently performed a computer simulation of the evolution of several Asian markets, to ascertain what is the optimal agent size and role in the marketplace. His conclusion was that there is no single optimal agent role; a *collective* of agents of various sizes and functions is optimal. The marketplace functions best with a variegated "ecology of agents," each of which has vital interrelationships with others, in the manner of an organism. Malone's system of atomized, independent transactors—i.e., an extreme market system—is inherently limited, said Clippinger, because it does not honor the systemic relationships or genetic variance needed to develop a highly intelligent, complex system.

C. The Importance of "Tribal" Relationships and Social Equity

Indeed, said John Seely Brown, a complex marketplace depends critically upon "communities of practice" which come together around shared values, habits and knowledge, all of which are implicitly communicated to its members. "This is how learning occurs—by becoming a member of a tribe, or community of practice," said Brown. "In that sense, a business organization is a community of myriad communities of practice. If we really want to understand the workplace of tomorrow, we have to look at how these communities of practice form, organize themselves and learn from each other." Particular attention must be paid to the *implicit* knowledge and mores of communities of practice, which are at least as influential as the explicit knowledge and mores.

Conference participants repeatedly raised concerns about how information technologies might intensify social inequities. Giles Merritt, European Affairs Columnist for the *International Herald Tribune*, asked: "What impact will information technology have on the 'rust-bowl' sectors of the economy? How can we avoid massive social disruptions? How can we harness information technology to recapture world markets and help the Third World? How do we generate more efficiencies from information technology to help our economies?" Other participants worried how information technologies might aggravate unemployment in Europe, or intensify the "two-tier society" of skilled professionals and unskilled hourly workers.

Marialina Marcucci, President of Gruppo Marcucci Communicazione in Italy, suggested that this ought to be a more urgent topic of concern—how

to harness information technologies to provide greater educational and job opportunities than are currently available. "How can the technology be used to help underdeveloped countries develop and become self-sufficient? How can it be used to train workers and create new jobs in existing companies?"

Unfortunately, the worrisome social impacts of information technology seem far more amenable to complex description than concrete reform. There appear to be no ready, feasible solutions, let alone a theoretical model for achieving social equity in a market-driven paradigm. On the other hand, there was a broad consensus among conference participants that the market forces driving information technologies will need to be tempered by deeper, non-economic human values. "People like us, in this room, are capable of living on the fringe between chaos and order in a complex world," said John Hiles of MAXIS. "But if we reflect on this fact, I think it is because many people did things for us that were not fair transactions. The first two or three fishing trips I ever went on were disasters; I lost the pole, I got my line stuck on trees, and so on. Why was I invited back? It clearly wasn't a transaction. . . ."

"There has always been a risk of using technology with arrogance and hubris," Hiles continued. "If you have a fair measure of humility, you must take the technology back to people who need it, to keep them connected [to the rest of society]. Why are some genes replicated in the gene pool even if they represent a detriment to the current order? Because there is a prospect that that particular characteristic might be the chain that keeps the species alive. It is a dangerous concept to think that we should make everybody sink or swim in an economic market."

IV. INFORMATION TECHNOLOGY AND DEMOCRACY

Some of the most urgent questions posed by the conference dealt with how information technology is affecting democratic values and culture, and how, with imagination, the technology might be deployed to help rejuvenate the body politic.

A. Fewer "Filters," A Faster Pace

Information technology has drastically shortened the time in which routine matters of daily life are conducted. Examples abound. In the stock market, computerized trading now uses price signals to activate stock trades, automatically, without deliberation or reflection. Because of 24-hour-a-day news channels such as Cable News Network, there is no longer a unitary "news cycle" that lasts a day, or half a day. Now, reports Jeff Eller, Director of Media Affairs at the Clinton White House, "We have a 24-hour news cycle. We are *never* out of a news cycle." Electronic business communication—whether through cellular telephones, facsimile machines or E-mail—has immeasurably accelerated the pulse of life in the workplace and marketplace.

Because of the variable rates at which information can be transmitted and absorbed, there is increasingly a hierarchy of knowledge. The most elemental forms of knowledge are *data*, raw, disaggregated, empirical facts. When organized and defined in some intelligible fashion, data becomes *information*. Information that has been interpreted and synthesized, reflecting certain implicit values, becomes *knowledge*. And knowledge that carries spiritually profound, trans-historical insights might be called *wisdom*.

While information technologies often produce their intended results—direct, rapid communication—they can also produce unintended, paradoxical side-effects. One paradox is the circumstance of people being "more informed" in one sense while also more disengaged and ignorant in another sense. For example, while producing a computer simulation about the functioning of an oil refinery, John Hiles of MAXIS learned how refinery workers sometimes learn about malfunctions at the plant: "We see a helicopter from the TV news flying overhead." An external information system is, in some cases, more reliable and useful than internal systems. Another odd side-effect is the numbing effects of too much information, even when that information is very disturbing. For example, although the world is intimately familiar with the atrocities occurring in Bosnia-Herzegovina, the world's moral and political response to that knowledge has been far more muted than might have occurred in a previous era. "Technology makes the entire globe 'guilty'," said Marie-Monique Steckel. "All of us know [about the moral horrors]. Now what do we do about it?"

One highly volatile intersection of information technology with democracy is the realm of presidential electoral campaigns. By general agreement, the 1992 campaigns represented a new watershed in the use of the electronic media to persuade and mobilize the American electorate. Jerry Brown pioneered the use of tollfree 800 telephone numbers to enlist volunteers. H. Ross Perot not only went directly to voters through half-hour network television broadcasts, he popularized the idea of "electronic town meetings" at which elected officials could meet with citizens. Bill Clinton, for his part, invited the public to communicate with his campaign via electronic-mail, and campaigned on unconventional television venues such as *The Larry King Show* and MTV.

"Disintermediation" is the word often used to describe the general effect of these innovations. The gatekeepers that once mediated our access to the world and interpreted it for us—journalists, editorialists, political parties, etc.—are being bypassed. Through information technology, people are obtaining *direct access* to news and politicians, without "filters." This direct access is indeed changing the character of politics and public debate, as complexity theory postulates. New "feedback loops" from the people to politicians are created, amplifying the influence of people who previously did not "matter" as much. One striking example of this was Ross Perot's 1992 presidential campaign.

Charles Firestone, the conference moderator and director of The Aspen Institute's Communications and Society Program, pointed out that disintermediation is generally accompanied by the rise of "neo-intermediaries," as he calls them. These are new intermediaries (either older intermediaries that have adapted or newly created ones) which are assuming the functions of the previous intermediaries—particularly by providing "knowledge navigation," systems integration and intellectual analysis in the new environment.

These neo-intermediaries—whether they be opinion polls, citizen town halls, toll-free 800 numbers or call-in talk shows—are creating a new and more challenging electoral milieu for candidates, as the 1992 campaigns demonstrated. This may well be a positive, empowering result. If citizens can have greater direct access to candidates for public office, candidates will face new pressures to be responsive and accountable—and citizens will be more likely to participate in campaigns and vote. "Immediate participation is here," said John Oltman, Chairman and CEO of SHL Systemhouse, Inc., citing the electronic innovations of the 1992 campaigns. "The real question is how to ensure that participation achieves reasonable objectives."

B. The Dangers of the "Electronic Mob"

On the other hand, the faster, more tightly interconnected communications systems of our times can also create "electronic mobs," warned several conference participants. Without intermediaries to interpret events, the public can be more easily manipulated and stampeded. William Janeway of E.M. Warburg, Pincus and Co. noted how radio talk show hosts rapidly mobilized senior citizens to fight proposed congressional cuts in Medicare benefits in the late 1980s. In this fashion, electronic technology can enable a vocal minority of citizens to summarily override the more dispassionate debates and negotiations of legislators, he said.

"Immediate, quick, direct communication now closes the space between people," said Charles Firestone, the conference moderator and Director of The Aspen Institute's Communications and Society Program. "But it also may lead to a lack of deliberation." Rapid communication can short-circuit thought and reflection. In addition, leadership in such a climate may be less willing to take risks or show long-term vision.

"But sometimes a 'mob' is simply an expression of democratic pluralism—citizens making their voice heard," noted David Bollier, a journalist and the conference rapporteur. "A mob generally comes into being when people feel that their voices have not had any public representation. Then some catalyst or opportunity presents itself which allows that voice to erupt, in frustration." In this sense, an electronic mob is a symptom of a closed political system.

An electronic mob may not be very attractive, said Morton H. Meyerson of Perot Systems Corporation, who served as an advisor during the early stages of Ross Perot's presidential campaign, but it can serve as a "useful

counterforce" to the constricted political agenda of television news and entrenched politicians, he said. "I have no regard for the networks. I believe they are absolutely manipulated by political people. That's what campaigns are—a cabal, a game, between campaigns and the press." An electronic mob can at least introduce authentic citizen voices into this closed agenda, he said—which, in Perot's case, represented nearly 20 percent of the electorate.

The television networks' credibility as filters, or intermediaries, is increasingly coming under attack, agreed Jeff Eller, Director of Media Affairs at The White House. A recent Times-Mirror poll showed that network news anchors are losing their public credibility, and that local television news is more highly regarded by viewers than network news. The fact that 220 local television stations recently banded together as an ad hoc network to produce a "Flood Aid" fundraising benefit—without any network involvement—dramatized the waning preeminence of the networks, he said.

One solution to the "electronic mob problem," said John Hiles of MAXIS, is to find better ways of "displaying the audience"—that is, to alert the political mainstream that there are certain minority interests with intensely held beliefs building up support, and then let the "electronic majority" mobilize itself. As the costs of video production and access decline, groups that might otherwise evolve into electronic mobs are more likely to have their own video outlets—just as computer desktop publishing made newsletter-publishing a cheaper, more accessible medium. Morton Meyerson argued that it is no longer prohibitive for insurgent political groups to gain access to television. Perot spent less than $10,000 to produce his television ads, and bought a half-hour of Saturday night prime-time access for between $200,000 and $500,000.

There are ways that the new television delivery systems could be used to enhance, rather than debase, democratic discourse, said John Seely Brown of Xerox Corporation. Moving beyond the top-down, one-way broadcast model that currently characterizes television, video communication could become more interactive, on the model of call-in talk shows. It could also develop into a "worldwide knowledge medium" with the versatility and accessibility of the Internet, he suggested. People could create and edit their own locally selected, individualized video feeds, which could be shared among a self-created group of people.

Disintermediation may have a less optimistic outcome, however, suggested Esther Dyson, President of EDventure Holdings Inc.: If technology shifts the "balance of power" from the press to the people, she said, "a lot of people will filter out everything except football or violent-crime news." If the technology thereby fuels a competitive race to the bottom, this puts an even greater burden on the press to be responsible, she said.

C. Reviving Democratic Culture and Education

To suggest how information technologies might be used to help revive democratic culture, John Seely Brown of Xerox Corporation, associate Paul

Duguid, and architect Susan Haviland, prepared a paper for the conference outlining six imaginary scenarios. The paper, "Towards Information Participation: Six Scenarios in Search of Democracy in the Electronic Age," described and then briefly critiqued the philosophical implications of each scenario.

In Scenario 1, "The National Electronic Town Hall," the authors consider the notion of all citizens being able to vote "yes" or "no" from their television console. This is a "nightmarish" idea, say Brown, Duguid and Haviland, because it overlooks democratic participation almost completely. Motions put to a vote are usually extraordinarily refined distillations of large and complex issues. They result from a long process involving conflicts, contradictions, and compromises. To understand the motion, you need to have participated in some of that refining process. And to vote responsibly on it, it is also important that you have a sense of the consequences. For people outside the process altogether, this extensive refinement actually obscures the issues that went into producing the motion.

A superior alternative, the authors suggest in Scenario 2, "The Town Hall Revisited," is one in which technology is used to tap into the diverse expertise and insights of the citizenry. They propose an interactive system that allows different people to ask questions, make suggestions and render opinions to a centralized forum, such as a city council. That way, the pre-con-ceptions of elite decisionmakers do not necessarily prevail, and the "distributed intelligence" of a community can be fruitfully tapped. Policy proposals can be modified and improved through a communal process, but final decisionmaking remains with elected officials—unlike the "electronic town meeting" scenario.

In Scenario 3, "Reorganizing," the authors argue that electronic technology could help new political constituencies form and develop, and make possible "new methods of apportionment [of voting districts] heretofore totally impractical." Instead of relying upon geographical boundaries, which are themselves subject to bizarre gerrymandering that prevent equitable representation, voting districts could be allocated to "affinity groups" that reach certain thresholds of size. This sort of reor-ganization of constituencies, facilitated by electronic technology, could help make a given government body (the city council, state legislature, Congress) more responsive.

One recurrent problem in public discourse is the ability of subcommunities to gain a point of entry to speak to, and participate with, the wider general community. Scenario 4, "Gaining Entry," suggests how an electronic bulletin board helped address this problem, based on an actual example. Prior to the Persian Gulf War, linguist George Lakoff placed an article on the Internet that discussed the use of metaphors in public debate about the growing diplomatic tensions. The article was too abstract for a general newspaper yet too timely to make a difference if published months later in a scholarly journal. But once made available to the electronic audience, the article was "quickly forwarded, cut-and-pasted, excerpted, annotated, and sent around the country. It made an invaluable contribution to understand-

ing, interpretation and debate by providing (like scenarios) a spine around which a body of commentary could form," the authors write. The lesson? "As new systems are designed that allow subcommunities to diverge, it is important that they do not reinforce old boundaries and further cut off intercommunal communication."

Scenario 5, "Intermediaries," suggests a similar sort of networking among citizens, by way of the local newspaper. Through a series of Internet-like electronic forums, journalists, editors and citizens are able to share specialized information, question and debate each other, and elaborate on issues that did or could not be published in the newspaper. Thus, instead of seeing on-line databases as a simple substitute for edited, hard-copy news, the local newspaper uses electronic technology as a way to *complement* the special community significance of publishing a newspaper. This scenario highlights a special challenge that new information technologies create. "On the one hand," Brown, Duguid and Haviland write, "new technology should not be allowed to destroy robust social practices held together by the old technology. But equally, once that challenge is understood and respected, the old should not prevent social practices and goals from developing with the new."

In Scenario 6, "New Strategies for Interpretation," the authors explore how information technology can help one group come to understand the special perspectives of another group. Xerox researchers, dissatisfied with the design of a particular photocopier, made videotapes of outsiders fumbling to perform certain tasks on the machine—a display that was needed to convince management that the product needed to be redesigned. So, too, one can imagine new uses of information technology that help members of one group, such as voters or lawmakers, understand what is at stake for another group.

Education is a realm in which information technology can play a hugely transformative role, said Barry A. Berkus, AIA, of Berkus Group Architects. Just as urban spaces need modular systems that are more flexible and organic—if only to help respond to accelerated social and technological demands—so too education must be more flexible and adaptable, said Berkus. It must be made more tailored to suit changing personal, economic and community needs. Berkus' vision: "organic, interactive labs where education can become entertainment."

A robust example of this model, he said, are the many public aquariums that are being built throughout the nation and the world. "Aquariums are an interactive educational system that encourages parents and children to interact," Berkus explained. "They are places where people *want* to learn." Using computers, colorful displays and actual sealife, the aquariums provide an entertaining and informative milieu in which to learn.

Judith Hamilton, President and CEO of Dataquest, fears that many discussions of how information technology can improve education are largely "irrelevant to the vast proportion of the population" who have

trouble reading, writing and getting stable full-time work, however unskilled. Berkus replied, "If education is made accessible to all, it will allow people to move up. It will also allow practitioners to participate more in the educational process." What is needed, said Berkus, is a greater commitment by corporations and the tax code to encourage vital "public goods" such as education.

This is indeed important, said Morton Meyerson of Perot Systems Corporation, who said he is convinced that the business community must show forceful leadership in promoting education reform. "If not corporations," he said rhetorically, "who?" All the other parties which could play a catalytic role here—state government, municipalities, unions—have not been effective, he said. "Yes, this moves business beyond [the mission of] increasing shareholder value," Meyerson conceded. "But the environment in which our companies exist must be dealt with." H. Brian Thompson of LCI International adamantly disagreed, on both philosophical and practical grounds: "I don't believe CEOs are capable of this task, or the appropriate ones to watch over the evolution of society. A company is just a market-based entity, no more."

D. Computer Simulations and Democratic Discourse

As the complexity of the world increases and information proliferates—while our society's expertise and values are fragmented—is there some way to forge a common ground, a way to instigate a new conversation about complex phenomenon? John Hiles of MAXIS believes that computer simulations may hold significant promise in allowing people to explore each other's values with respect to complex systems.

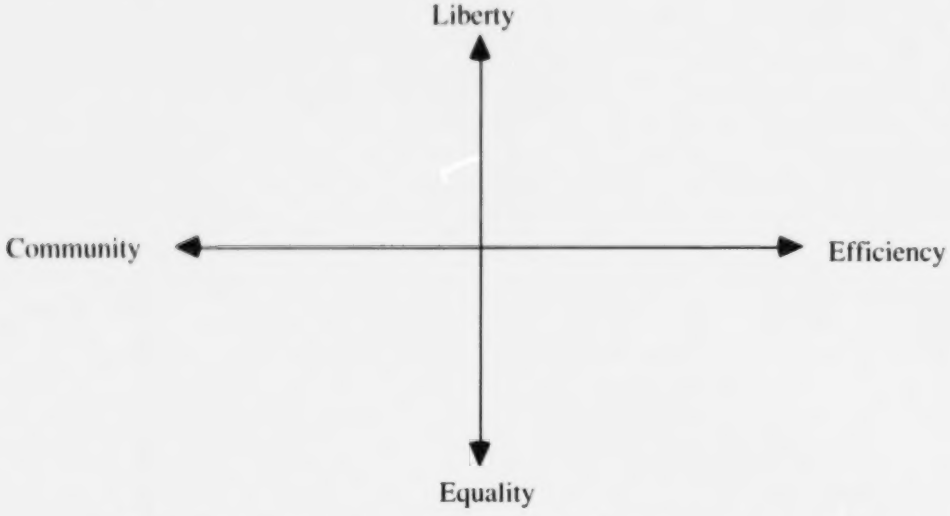
In a presentation to the group, Hiles demonstrated a prototype of a new computer simulation, SimHealth, that MAXIS plans to release in the fall of 1993. The program simulates the process of formulating national policy and legislation for the U.S. health care system: precisely the process that Hillary Rodham Clinton's National Health Care Task Force has been engaged in for months. Funded by the John and Mary R. Markle Foundation, SimHealth is not an expert system or database. It is essentially a communications and educational vehicle in the guise of an interactive computer simulation—"a notational system to focus conversation" about complex systems, Hiles explained.

SimHealth is inspired in some ways by one of MAXIS' most popular products, SimCity, an educational software game that simulates urban design and planning. More than one million copies of SimCity have been sold, and between five to ten million people have played it. By contrast, the best-selling book on urban planning has sold about 20,000 copies. Perhaps the most important feature of these computer simulation games, said Hiles, and one reason they are so popular, is that they invite the user to create their own stories and sense of meaning, by interacting creatively with the software. Primitive humans created stories about how to avoid that leopard out

on the plains, said Hiles. Because the leopard is not generally seen—but only its impact—people use stories in order to create meaning and obtain a larger, aggregate understanding of the leopard's significance.

This is the analogous purpose behind SimHealth, said Hiles. It is a means for people to create their own stories about something "out there" that is too complex to easily understand. By letting people explore the complex dynamics of a system through interactive (simulated) experiences, the software helps non-specialists obtain a crude overview of a given area. It shortens the "learning curve" that non-specialists typically encounter in a highly complex, jargon-ridden field of knowledge. "There is not a single person in this room who would be allowed to steer the United States' health system however they pleased, just to see what would happen. But with a simulation game, you can do that in the confines of a personal computer," said Hiles.

The centerpiece of SimHealth is an "executive compass" of values, which the player uses to declare his or her moral and social priorities in designing a health care system. [The "compass" was developed by USC management professor James O'Toole, and is described in O'Toole's book, *The Executive's Compass* (Oxford University Press, 1993).] Using a diamond with four poles, each player chooses a specific blend of values they want their health care plan to embody.



The "values diamond" is an attempt to force players to realize that certain values involve trade-offs with other, competing values: absolute liberty means no equality, and absolute efficiency means no bonds of community. In SimHealth, the choice of different values yields different design goals—as well as different measurements of success. "Winning" at SimHealth—winning re-election after 16 years in office—is based upon how well a player succeeds in constructing a health care system that embodies his or her stated values, as declared at the beginning of the game.

One of the primary screens used in SimHealth is a depiction of a town, with different city blocks representing key social institutions: the hospital, the physicians' services building, medical technology providers, the town hall, the courts and police center, the residential neighborhood, big businesses, small businesses. Animation is used to dramatize what happens to this metaphorical town as a result of different health care policies. If no new policies are instituted, for example, and health care costs continue to expand at 13 percent per annum, both the hospital and physicians' services building visibly expand and shunt surrounding institutions into the corners. Animation shows a visible deterioration of schools, the courts and police center, and neighborhoods, for example. Or, alternatively, if there is a large expansion of government, the building representing government will expand and squash the institutions adjacent to it. Nearby housing will become shabbier, and the local medical society building will shrink.

Animation is also used to "look inside" each of the city blocks. At the hospital, for example, animation shows ambulances arriving at the emergency room; patients checking into the hospital; physicians working at the hospital; the amount and quality of medical equipment; etc. Thus, if a given set of health care policies stimulate demand for services without providing corresponding increases in supply, then queues of patients will form outside the hospital, along with traffic jams of ambulances and crowded hospital rooms and halls. If the mouse is "clicked" on a person such as a physician or patient, the game will give a summary of that person's problems and frustrations.

A "policy screen" offers a variety of policy options from which a player may choose. Each option entails a specific monetary cost as well as a cost of "political capital," which increases or decreases depending upon whether a player's health care system advances his or her self-selected values. If a player decides to provide universal health coverage, for example, the game requires them to find the money to pay for it. If the money is projected to come from new efficiencies in the system—but those efficiencies never materialize—then the player goes into a deficit. Charts also show how much of an average citizen's taxes or wages are underwriting the cost of a given health care system.

SimHealth mimics many of the dynamics of the real-life health care system. At some points, for example, the game announces that researchers have developed a new genetic test to detect this or that disease, at a cost of $\$x$. Should this new medical test or technology be covered by the national health care system? The player's answer to this and similar questions sends signals to various participants in the health care system. Medical technologies providers may rein in their research or instead, develop more cost-efficient technologies; physicians may develop a keener appreciation for prevention.

One of the most obvious problems in designing a game like SimHealth is how to take into account politically controversial perspectives. SimHealth resolves this issue by asking players to choose whether the costs and

statistical projections for their national health plan should be based upon "easy," "difficult" or "custom" assumptions. Easy assumptions are those used by advocates of a given policy; difficult assumptions are those used by its critics. "So controversy is built into this model," said Hiles. "It is not external to it. We are not taking a 'middle-of-the-road' approach using 'objective experts'." While this model does not allow for great precision, especially ten or twelve years hence, it does show realistic contingencies. For instance, if a critic's assumptions about caps on physicians' salaries are simulated, the game will show a tremendous cutback in hours worked per day by physicians, and long queues of patients. The precise size or dollar value of such impacts may be less important than the casual relationships that the game delineates.

SimHealth may have an important practical impact on participants in the health care debate, said Hiles, by prompting partisans to take their critics' substantive positions more seriously. It helps players understand a larger common good that stands above individual, partisan interests. Instead of deflecting an opponent's criticism with bald denials or rhetoric, as so often happens in public debate, players in SimHealth are forced to come to grips with the different perspectives of factions in the health care reform debate, said Hiles. He cautioned that SimHealth does not purport to forecast the future (which would require far more rigorous data, if it were possible at all) or to declare which health care system is best. "SimHealth is designed to give people an easy, convenient notation for making stories, and telling each other stories, about the values behind their health care views."

But does SimHealth truly replicate the real-world economics and politics of health care reform? Are its assumptions valid? Can *any* set of assumptions about this complex policy debate truly be replicated by a computer simulation?

Michael Niebel, Member of the Cabinet of Vice President Bangemann of the EC Commission, charged that real-world developments may evolve in many different ways, depending upon who you talk to. "There are a lot of gray zones, in which experts have different perspectives," he said, and this may not be accurately integrated into the software. Similarly, Giles Merritt of the *International Herald Tribune* worried that SimHealth "could backfire on us very badly. It is full of rigidities. It is only as good as the information put into it. It does not take into account population shifts, the enormous variables in how the U.S. economy may evolve, or the future demographics and health behavior of the underclass."

Hiles responded that the only responsible way to design this sort of program is, first, to use only responsible information sources, and second, to open up the design process and its assumptions to outside review. "If you're serious, then you won't produce a 'black box'," said Hiles. "If you do produce a black box, you may sway people until someone figures out how to pry open the box" and demonstrate the methodological deficiencies or biases. At that point, the program's value as a communications tool is "zero," said Hiles. Jeff

Eller of The White House, pointed out, "If a computer simulation becomes an editorial vehicle, even in the slightest, that will be found out at some point, and further people's discontent and alienation. The simulation must remain editorially neutral."

Will SimHealth have any impact on national health care policy or how it is discussed? Jeff Eller predicted that the software "could have a pretty significant impact." While it may not resolve the conflicts of values, "Anything that increases the base of knowledge among people helps the democratic process, especially if it helps to re-establish the connection between individuals and their government." SimHealth, he agreed, provides a vocabulary for articulating and discussing the values in the health care debate. John Seely Brown of Xerox Corporation believes that simulations such as SimHealth "can provide 'ownership' for ways the world can evolve, which can reveal new richness—and thus affect the policymaking process."

But can simulations really stimulate change? Ray Lane, President of Oracle USA, remains skeptical. He cited the case of Caterpillar, the heavy-equipment maker, which used a computer simulation to help its executives explore the implications of the company's possibly entering the global heavy-duty truck market. "After playing that game," said Lane, "nothing changed, because the executives were too busy looking at today's market position and trying to deal with that." Computer simulations may or may not stimulate change. A more critical factor, Lane asserted, is "the capacity of individuals to change and take risks."

V. CONSTRUCTING A VISION FOR INFORMATION TECHNOLOGY

Most attempts to plan and achieve a desirable future require a *vision*, an imagined sense of what can and ought to be. But the conference discussion about "complex adaptive systems" and "knowing in action" (outlined in Section II) suggests that it may be futile to propose a final, utopian vision. What may deserve the most attention is the *process* by which we move into the future. It may be more important to foster decentralized experimentation, emergent voices and "genetic variance" within a group, than any particular, unitary "vision."

In the future, predicted Jim Burns, Chief Operating Officer and President of SHL Systemhouse, vision will emerge from "networking at lower levels, pursuing 'mini-visions' below the chaotic macro-level." William Janeway concurred: "The sources of vision will come from decentralized areas, not from the mainstream. At the center, the language of vision has been debased, deservedly so." And yet, said Janeway, responding to his own proposition, a vision based on complexity theory "can be a threatening metaphor because it imposes responsibilities 'out there' in the evolutionary system, where change cannot necessarily be predicted or controlled."

What may be most critical to any vision, asserted John Seely Brown, may be the *values* it reflects, because "your values are properties of the system you create." Brown believes that any vision must focus not on a particular destination, but on those values and "how to advance the dynamics of a system." Information technology can play a key role in this task by accelerating the natural tendencies of complex adaptive systems: honoring emergent voices, genetic variance, feedback loops, and so forth. "Informed participation" must be nurtured. But, in honoring these evolutionary forces, Brown counseled, "We need to develop protocols to escape protocols." That is the best way to advance a stable, long-term vision.

But even such a process-oriented "meta-vision" needs a distinct *image*, said John Hiles of MAXIS. "If a vision is going to be a motivational tool, you must be able to *see* it." One way to do this, Hiles suggested, is by helping the public develop shared values and see itself in the aggregate. Computer simulations such as SimHealth can help provide feedback so we can construct an aggregate image, or vision, he said, and so non-specialists can participate in the process.

If a vision is to be credible and powerful, John Clippinger of Coopers & Lybrand agreed, it must engage us at a visceral and almost metaphysical level. "Vision is like a creation myth," he said. "It is a set of ordering principles that gives people a place in the universe. It is a framing of reality." The implications of these insights for policy are both far-reaching and sobering, said Clippinger. "As we move away from mechanical models to a co-evolutionary one, policy becomes an empty lever. Instead the challenge is to instill values in technology and organizational vehicles."

If technology, organizations and the marketplace do function according to the principles of complex adaptive systems, as theorized, then the value of policy as an instrument of change certainly becomes more problematic, or at least more complicated. Policy interventions could hinder the development of a complex market or business organization. On the other hand, a *laissez-faire* approach to the evolution of new technologies and markets raises its own set of questions, also unresolved, about how social inequities can be minimized and democratic values and cultural harmony fostered.

For now, there is no clear conclusion about a singular vision, conceded Charles Firestone, the conference moderator. But that may be the real message of the discussions, he said—that singular, comprehensive visions are obsolete. To the extent that the future conforms to complexity theory and John Seely Brown's notions of "knowing in action," vision will emerge of its own accord, and we will be both actors and instruments in its emergence: a yin and yang of "informed participation."

APPENDIX A:

TOWARDS INFORMED PARTICIPATION:
Six Scenarios in Search of Democracy in the Electronic Age

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TOWARDS INFORMED PARTICIPATION

INTRODUCTION

For the roughly 2,500 years of the history of democracy the technology on which it has relied has not changed much: the voting machine is not a great advance over the paper ballot, the head count, or the voice vote. Of course, the technologies available have changed out of all recognition. For the moment, however, most new technologies lie on the periphery of democratic practice. The telephone solicitation, the television speech, the broadcast congressional debate, the faxed petition, the e-mail lobby, the interactive network are widely used, but they have not yet been formally made part of democratic practice. Society now faces major decisions about whether and how to integrate new technologies and old democratic practices.

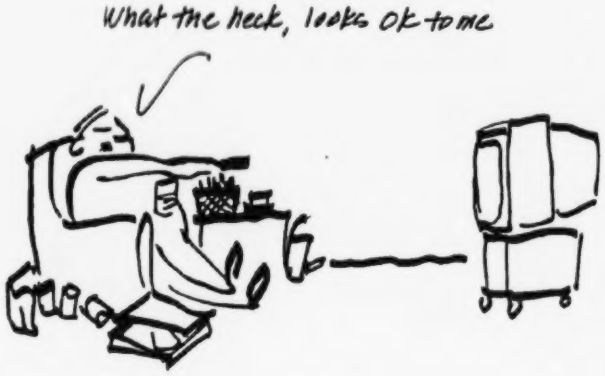
The advantages offered by new technologies are exciting and inescapable. Designed with care, they can offer society the opportunity both to engage more people in democratic practices and to engage people more directly and in new ways. The notion of "empowerment" has, we must admit, been somewhat overused. Nonetheless, we feel that information technologies genuinely offer the chance to empower people, both in the workplace and in society at large, who for one reason or another have become either effectively disenfranchised or merely disenchanted.

Much of our optimism, however, turns on that phrase "designed with care." Technology itself is not inherently empowering or progressive. Consequently, we need to learn how to use new devices to overcome constraints. But we need to be careful not to destroy the valuable resources inherent in democratic traditions. And we need to realize that any technology will impose new constraints at the same time that it provides new resources. Take, for example, the venerable architecture of democracy. In the nineteenth century, new buildings were designed to support new democratic governments. But they simultaneously built in certain limitations. The long benches to right and left of the speaker in the British parliament simply assumed a two-party system. The rounded chambers of the Capitol building escaped these straits. But these rooms were built to house the representatives of a population of some 25 million people. Now they have to serve the representatives of a population ten times that size—though the space clearly will not support ten times the number of representatives.

Few would be ready to sweep away these buildings and replace them with virtual parliaments, but issues concerning democracy and its technological resources and constraints need to be raised and discussed. That is what we try to do here, by presenting a set of six scenarios that we have developed to help refine our own understanding of the relation between technology and democracy. These, we hope, will raise issues, provoke discussion, and engage others in the debate. If they do, then they, in their own minor way, may have become technologies for democratic practice.

1. Ruling by Plebiscite

Scenario 1: The National Electronic Town Hall



In the not-too-distant future, every household may be offered 500 infotainment channels. People can engage in home shopping, game shows, and so on by way of a Minitel-like unit attached to the television. Democratic participation may also be included. The infotainment channels provide the "issues." Two-way capacity allows participation. People can vote "yes" or "no" from a button on the remote control. First people vote for representatives from home. Then issues of policy, governance, and polity are opened to popular vote. People vote on bills and amendments. Then they vote on foreign policy and trade policy. Eventually they vote from home on appointments, impeachments, budgets, and constitutional amendments.

In developing scenarios around the topic of democracy and technology, it is quite easy to produce rather nightmarish ideas like this one. It is also quite useful. Dystopian scenarios quickly provoke us into asking both what is wrong and what would make it right?

The sort of rule by continuous plebiscite envisaged in Scenario 1 is disturbing because it replaces almost every other sort of democratic participation with the "yes" or "no" vote, simultaneously distributing power and diluting responsibility. It is as if all opinion polls were immediately acted into law. And like opinion polls, such a system assumes that we are all ready to provide answers to incredibly sophisticated questions at the flick of a switch. But for most of us, our instant opinions resemble the famous philosophical conundrums about the tree in the forest or the light in the refrigerator. We can't really be sure the opinions were there before we were asked. They are

as likely to have been formed in response to a question as to be formed before the question is asked. And thoughts formed on the spur of the moment should not bear equal consequences with thoughts reached over time and through careful reflection. So, while even the most complex issues may come down in the end to a single "yes" or "no" vote, we may not all be equally qualified to take part in that vote.

In fact, motions put to a vote are usually extraordinarily refined distillations of complex issues. They result from a long process involving conflicts, contradictions, and compromises. To understand the motion, you need to have participated in some of that refining process. And to vote responsibly on it, it is also important to have a sense of the consequences.

For people outside the process altogether, this extensive refinement actually obscures the issues that went into producing the motion. The political process can tend to make complex issues look misleadingly clear, hiding what is really at stake, much as distillation provides no trace in the clear spirit that emerges from the thick grains that went into the still. The clarity of a single "yes" or "no" vote, rather like the simple diagrams drawn to simplify the picture on a television screen, may turn us all into adept and critical Monday-morning quarterbacks. But they are no indication of how reliable we are on Sunday afternoon.

Among other things, the first scenario suggests to us that refined information provided to passive viewers is not enough, on its own, for people to act responsibly; that participation means more than answering "yes" or "no" to a particular question; and that engagement rather than detachment is a prerequisite for full democratic participation.

On the other hand, we realize that all people don't have the time to participate equally fully in all aspects of the political system, in order to become equally engaged and informed. In the future, as in the past, society must rely on intermediaries. So, for us, the first scenario also suggests that technology may be better used not for direct access to every political vote, but for access to and through intermediaries and, perhaps more importantly, for helping to form and reform intermediating institutions.

My name is Bill Wieand and I live at 1800 Locust Avenue. I don't support this proposal and, furthermore, I question the assumptions behind the simulation...

2. Representation

Scenario 2: The Town Hall Revisited

The city council of Barchester is meeting to consider changes to the city's zoning ordinance proposed by a planning task force. New building envelopes are discussed. To help, drawings are presented in three-dimensional representations on video screens. People use these to investigate volumes as well as footprints, to see

where shadows may fall, and to explore relations to other structures. Moreover, with them people can follow the significance of different suggestions to see what happens if setbacks are changed, if sidewalks are widened, if courtyards are opened to the public.

Other simulations suggest how new buildings might fit into the social as well as the physical environment, what effects on city services and tax base changes might have. These are deliberately underconstrained, providing a set of issues and alternatives for discussion, not definitive results for arcane economic models.

The city council meeting is available to all city residents over a network. People caught at home for one reason or another can, like those in the council chamber, express their own doubts and questions and see on their televisions the results of their suggested alterations. At the end of the meeting, the council votes to approve a modified set of proposed changes.

There are clearly similarities between this and the first scenario. Both record attempts to expand democratic participation. But there are also important differences. In the second, "informing" does not involve sending distilled information in one direction, and participation is not limited to a "yes" or "no" vote going in the other. Instead, we have a process that tries to expand and also, importantly and reciprocally, to tap knowledge in the community. People know in different ways and a well-organized democratic process can and should bring out and make use of the different types of knowledge, as, for instance, this council draws on the town's distributed intelligence, not just that of "experts."

One significant way to do this is by overcoming the division between experts and the public. With technical matters such as planning issues, this division usually falls between those used to dealing with technical data and everyone else. Planners and architects can quickly envision the entailments of a three-dimensional building from a two-dimensional set of drawings. Economists are used to speculating on economic models. The comparative inexperience of the general public too easily excludes them from joining the debate. Yet these are the people who live in Barchester and they have a strong sense of what does and does not work for their community.

To tap this knowledge certain choices must be made in the design of the support technology. The system for displaying designs, for example, needs both to provide good three-dimensional representation and also to enable suggestions to be modelled quickly, so that the entailments become easily apparent for people inexperienced with plans or models. For their part, the economic simulations need to be open and underconstrained. If they are overly determined, then the expert–citizen rift opens up once again. "Conclusions" that appear incontrovertible will close down discussion for all but the initiated. On the other hand, if the models are suggestive rather than definitive, they offer a means to help elicit implicit knowledge.

Thus a goal of social participation will produce very different design from the goal of technological or theoretical precision. For participation, a system should not be a conduit for preconceived and incontestable ideas. Rather, it should be a forum—very much in the sense of the public political space at the heart of a Roman town—for people to gather and where, when necessary, they can contest the preconceptions that go into public policy.

Whether people actually participate or not, the possibility of participating plays an important role in the extent to which people become informed. We have probably all drifted off into reverie during political speeches broadcast on the radio. By contrast, call-in shows with the same politicians tend to hold us more directly. This is probably because, even if we don't participate, the option of participating incites us to frame our own questions, to predict how they might be answered, to hone them in response to some of the answers given, or to make fine comparisons and distinctions when someone else asks a question close to ours. In this way the right to participate may be as important as the act of participating in producing a well-informed public.

The second scenario is also different from the first in that, while it may change the forms of visual representation, it does not significantly change political representation and responsibility. The responsibility for the final decision remains with the council. This is not a denial of democracy. Participation is not achieved by plebiscite alone. The council actively solicits responses, questions, objections—detailed contributions from the public. Technology offers quick means to register these and to assess and display their entailments. The public meeting can develop the original submission through the insights offered and captured in the communal process. Nonetheless, the technology doesn't preempt legislative responsibility: it is still the council that takes responsibility for deciding the issue.

3. Reorganizing

Another distinction between the first and second scenario is that the first treats every member of society as an individual with an equal say in all issues. It ignores any sense of community other than the nation at large, replacing pluralism with the plebiscite. The Barchester Council, by contrast, recognizes that with regard to certain issues, its constituency and its constituents form a community of shared interests.

Historically, for a variety of good reasons, political notions of community have been based on geographical areas. But, as the sociologist Anselm Strauss pointed out some time ago, our increasing mobility has given us the need to form distal communities—groups whose members are not physically copresent. New technologies increasingly allow these to form with great rapidity. But political constituencies remain carved out as before. In the future, they may need to reflect changing notions of community as the following scenario suggests.

Scenario 3: Forming New Communities

It is election day in Barchester. Most people have already voted at home or at work using personal computers connected to the polling network established and maintained by the League of Women Voters. Some, who for financial or philosophical reasons have no easy access to a networked personal computer, visit a polling place, such as a public library, which importantly makes public terminals available to all.

Upon accessing the polling system, voters type in their social security numbers to gain access to a ballot. Many levels of government are combined in this election. Barchester has four city council and the state seven congressional contests.

A voter's social security number acts as a polling number. If the number has not been used already that day, it will produce a ballot designed for that particular voter. If the voter is registered as a resident of Barchester, the ballot will include a list of candidates running for city council. In this particular election, there are twelve. Each voter can vote for up to four candidates. The four candidates with the most votes are elected.

If the voter is registered as a member of a group having a congressional election, the candidates for that election also appear on the ballot. Each voter votes for only one.

In the past, depending on where a voter lived, he or she was a resident of a congressional district. Attempts, such as the Voting Rights Act, to provide representation which was truly reflective of a state's diversity had led to congressional districts of a bizarreness which boggled the mind. With the advent of electronic voting and electronic registration new methods of apportionment heretofore totally impractical became as easy to administer as anything else. Two years ago the state separated congressional apportionment from geographical location and associated it with so called "affinity groups." Groups above a certain size are allowed to elect one member of congress. Groups below that size may band together.

Residents of Barchester, which has a great deal of civic pride have, indeed formed a group of a size sufficient to elect two representatives to congress.

Notably, this form of redistricting questions preconceptions about the locatedness of communities in spatial boundaries for all issues, while nonetheless realizing that the town and the state are both important aspects of community formation. What it suggests is that different forms of mediation may suit different political forums. The intermediaries sent to congress may be based on criteria other than geography.

Scenarios like this one immediately raise important questions about both the extent and the quality of the access a new voting system provides. With regard to extent, as we noted at the beginning, technology, can easily be limiting. Certainly if electoral processes are open only to those who have or are familiar with informational technology, then the new systems will be profoundly and damagingly limited. Even providing terminals to every household is not enough to guarantee that people will be able to use them or comfortable in doing so. This is why we noted that public libraries should have voting terminals. These would significantly provide not only access to terminals, but the social resources to enable people to use them. Community libraries and librarians have long been crucial resources for people faced with the unfamiliar, and we think that it is important that they continue to be so. Thus where some see information technology sweeping away libraries as we have known them, we suspect that the individuating and often isolating effects of such technologies will probably make community libraries more important than ever before. (Of course, the library does not solve all questions about the extent of access. We use it only as an example of the way in which such questions should be approached—through drawing on existing, well established resources rather than looking for new ones.)

With regard to the quality of access, we think it is important that systems designed to support participation should be designed with community practice as a priority. The experiment in town democracy going on in Telluride, for example, has wisely distinguished supporting communication within the community, from supporting communication between Telluride citizens and those in other communities. To connect everyone to the Internet or a future "information superhighway" will not solve all problems of informing and participating at the local level. Recognizing this, the designers have wisely made it their primary goal to connect town members to one another and to provide the specific resources town members feel they need, in short, to support local participation as much as possible in a shared, informal system that honors the local sense of community, local needs, and local interests. To tie this into broader national and international networks, which are structured globally rather than locally, is then a second, distinct goal. The Telluride plan recognizes that local intensity of participation is not practical on a global scale, nor are global constraints helpful on a local one.

To return to the scenario again, using technology to reconceive and reconstitute the ways in which society and community are organized has evident implications for the workplace too. As organizations develop and innovate, they too develop new constituencies that emerge between or across old organizational structures. And as with political constituencies, these do not necessarily reflect geographical contiguity. Organizations, as well as states, would benefit from the capacity to change in response to emerging constituencies in their midst. The ensuing re-organization might indeed produce a new (and revitalized) organization.

4. Points of Entry

In the previous scenario, the flexibility provided by new technologies helps to develop new kinds of communities. If society is organized around communities and politics around intermediaries, then we also need to understand how to help communities work together, how to pass information between them and how to support participation across their borders.

For this, we have to recognize that the circuit of information is not universal or uniform. Within groups, information is passed around by people who share common interpretive strategies. Shared understanding is really what defines a robust group. But different groups have different ways of knowing. Differing interpretive strategies, then, distinguish groups. It's because of this divergence that we argued the city council in our second scenario should try to tap as many as possible diverse constituencies within its jurisdiction—to take advantage of the multiple ways of knowing.

But if knowing differs from one community to another, what happens to information when it crosses one community's border and passes into another? Inevitably, it is often helped along by the most important boundary crossers—people themselves. We all inhabit many different communities and often implicitly play the role of simultaneous translator between them. But where information is sent rather than carried between communities, what the sociologist Leigh Starr calls the "boundary object" is important. This is an object capable of consistent interpretation in more than one community.

Consider, for example, drawings that might be presented during the city council meeting described in Scenario 2. Such drawings stand on the border of several communities—owners, architects, engineers, council members, neighbors, bankers, building inspectors, and so on. The drawings gather specialized knowledge from any one of these communities and allow it to be scrutinized by some of the others. The drawings are still not universal, but they are intercommunal. The three-dimensional display system for the council that we described in Scenario 2 is intended to extend that reach, transforming technical drawings into publicly recognizable building shapes. Similarly, the sorts of economic simulations we suggested in the same scenario should help different groups to understand each other.

Designing technology that provides mutually accessible information and supports intercommunal participation is not simply a process of opening channels. Negotiated points of entry and boundary objects are also needed. This is not only true of technical drawings and data. It is also true for political commentary, as we try to suggest with the following scenario.

Scenario 4: Gaining Entry

In a period of delicate diplomacy that could lead to an outbreak of hostilities between two countries, a scholar recognizes in the escalating debate in *The Thunderer* an esoteric but important point. He submits an article to the editor, but she thinks the topic too abstract for newspaper readers and suggests a scholarly journal. The author knows the piece will then appear too late and before too small an audience to affect public opinion about war. So he puts the piece into the newspaper's on-line debate between readers and journalists about the current situation.

Other readers see that the piece is highly relevant. It circulates at the speed of electronic mail and is introduced into other electronic communities. Participants select and annotate sections that are most forceful, and by default leave those that are too specialized. In the process the article critically shapes aspects of the public debates in local networks, and in return it is also shaped by it. As the article gains momentum and accolades across the network, the editor realizes her mistake and the original argument, now further refined, is taken up by the newspaper.

This scenario is not entirely imaginary. Before the Gulf War, the linguist George Lakoff put on the Internet a discussion of the metaphors used in the public debate. In what ways was Sadam Hussein like Hitler? In what ways had he initiated a "Holocaust," or practiced genocide? What were the consequences of using such metaphors in public debate?

The discussion was extremely timely and circulated with incredible speed. It was forwarded, cut-and-pasted, excerpted, annotated, and sent around the country. It made an invaluable contribution to understanding, interpretation, and debate by providing (like scenarios) a spine around which a body of commentary could take form.

But despite its evident appeal, there was simply no recognized point of entry into more public, national forums. The article was picked up by a couple of talk shows and Lakoff was interviewed, but the growing interest unfortunately lacked an entry point into the conventional community- and consensus-forming press. The process of "promoting" a discussion from one level or community to another is undoubtedly complex and at base social, not technological. But as new systems are designed that allow subcommunities to diverge, it is important that they do not reinforce old boundaries and further cut off intercommunal communication.

5. Intermediaries

So far, in referring to intermediaries, we have predominantly had in mind politicians and political institutions such as councils and Congress. But as the previous scenario reminds us, technology has long provided other mediating forms, in particular those that are not inappropriately referred to as "the media." The press has long played a highly influential role in politics and continues to do so. But like other political forms, it too is being challenged by new technologies, such as the Internet. (The popular author Michael Crichton recently likened the press to the last of the dinosaurs, facing and deserving extinction.) The following scenario outlines a response to that particular challenge.

Scenario 5: Subdividing

The Barchester newspaper, *The Thunderer*, recognizes a problematic conflict in its goals. If, on the one hand, it uses information technology to allow readers to make up their own newspapers individually, it abandons its role as the provider of a single paper to a large audience and thereby as a source of integral support for the community of Barchester. Instead, it turns itself into a company with no more of a community-forming role than any other public utility.

If, on the other, it continues to deliver news only on paper—in a form that dates back to the eighteenth century—it is denying the possibilities that are now available for more open, less controlled social communication. In particular, it is resisting pressures for more reader-driven contributions and debate, more versatile responses to its community.

After much deliberation, the editors realize that their mistake was to see this as an "either-or" decision. They do both. On the one hand, they keep putting out a hard-copy edition. This shows very clearly what the paper, as the town's collective mouthpiece, stands for and what it considers news. In this way it continues to play the important role of forming and informing a collective readership.

But the paper also establishes a series of on-line forums in which readers, journalists, and editors can focus on a particular topic. Interested readers are encouraged to lead the debate, to question, to challenge, or merely to ask for more information. Journalists join too, justifying and arguing, but also providing material that got spiked for reasons of time or space or

> that has emerged since the story appeared. As their members choose, the on-line cadres of readers and writers (which even include people *in* the news) expand, contract, or split up into further subspecialties that address related topics.
>
> In some cases, they collectively agree that a certain issue has reached a critical mass. They indicate to the editor that this issue, which previously came down to their specialized interest group, might now be sufficiently interesting to go back up to the broader public through the hard-copy paper, where the topic was first raised.
>
> The paper is now a truly public forum through which stories circulate. The paper does not lose its status as a locus of publicly shared information. The editors retain responsibility over what appears in the paper. But the processes of inclusion and exclusion are open to public debate.

This view of a newspaper's role helps us to develop our emerging sense of what "informing" really involves. As the word itself suggests, it is in part a process of giving "form" or shape. Along with delivering the daily news, newspapers also inform a community in this way. In providing everyone with the same information, the newspaper simultaneously evokes and reflects a shared sense of what is important or interesting. In sharing this common source, readers collectively develop understandings that further bind them into the community. If they are to continue to develop and to remain genuinely live communities, distal communities in particular badly need common objects like newspapers, journals, and newsletters circulating among them to help keep them informed, in both senses of the term.

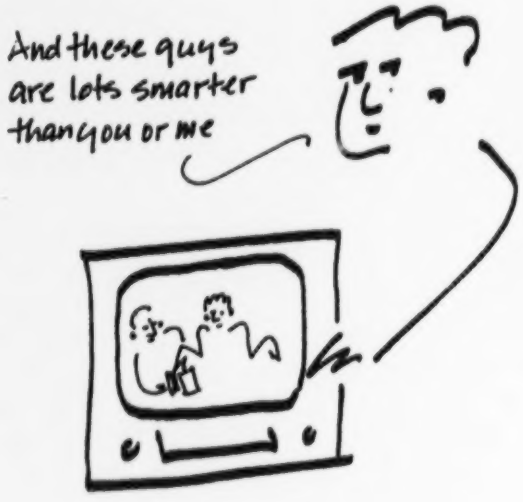
The best way newspapers can inform and support communities, then, is not to transfer their edited, hard-copy into amorphous, on-line databases or to turn themselves into another node on the Internet. That way they surrender one resource in the face of another. This is as if society had abandoned trains as soon as the car came along. The increasing pressure on parking spaces around urban train stations indicates how cars and trains continue to enter into healthy symbiotic relations. So should newspapers, information databases, and mail & "chat" facilities. These should both connect, interconnect, and complement one another.

6. New Strategies for Interpretation

One particular problem with communication between communities is that a glaring issue in one may not even be visible to another. To understand another's point, people may have to change their interpretive strategies. This can take more than a memo or an e-mail message.

Scenario 6: Getting it Wrong

When meetings, minutes, and even demonstrations had failed to convince management of the problems with the usability of a particular photocopier, some researchers at company 'X' tried a different approach. They asked pairs of outsiders to use the photocopier to accomplish a standard task while being videotaped. Recording the actions and the conversations of each pair allowed researchers to examine the source and the nature of the confusion that arose. They then edited a segment of one particular pair attempting the task. The tape showed the two trying valiantly but failing miserably. This tape was then shown to management, and after it was shown the two volunteers were revealed to be highly distinguished and competent scientists. Managers quickly and very literally saw that something was seriously wrong.



This scenario is based on a real sequence of events. Company 'X' is Xerox and the problem arose in part because management knew the machine too well to understand how difficult it was for outsiders to use. To come to see outsiders' difficulties they needed to shed their insider status and put themselves in the outsiders' place. The video accomplished this transformation and allowed the managers to see the copier with others' eyes.

This sort of transformational role may be particularly important for technology to play in supporting democracy. It can help influential members of one group, such as voters or lawmakers, see what is at stake for another group such as those whose lives will be directly affected by a vote or law.

TOWARDS INFORMED PARTICIPATION

In laying out these scenarios and raising issues around them, we have challenged preconceptions about knowledge and information. Scenario 1 and, unfortunately, a good deal of information technology assume that information is something that can be packed up at one end of a communication channel, shot over to the other end, and received pretty much as it went in. (Linguists call this assumption the "conduit metaphor.") The person who unpacks at the receiving end is then assumed to "have" the knowledge and be able to act on it.

This approach to knowledge and action, however, puts the cart before the horse. Knowledge of the sort that gets passed around in abstracted form is very much like the political motions we discussed. It is not a precursor of

action, but a result, distilled out of action. Such knowledge is so concentrated that it is often unintelligible to the uninitiated.

In fact, stories and anecdotes rather than abstractions and concepts are the key resources in the process of informing. We all use them and they are incredibly powerful. Take, for example, the historian Shelby Foote, who provided such extraordinary and acclaimed insight into the Civil War in his PBS series. He did this not by giving names and dates and casualty lists (the conventional didactic approach), but by producing small vignettes.

Similarly, at work we all circulate and sharpen our collective knowing by telling each other so called war stories. The anthropologist Julian Orr has shown how much people depend on these textured accounts of practice. When the technicians he studied faced an impasse, they recalled, reconstructed and reconstrued story after story about previous jobs in order to come to a solution for the difficulty at hand. Such stories are a particularly important store of everyone's working knowledge.

As stories circulate the people that share them develop a collective sense of how they should be interpreted. These shared interpretive strategies provide a context for understanding actions and concepts which would otherwise be open to a variety of interpretations. This is why stories rather than instructions are so useful for newcomers trying to learn from old-timers.

From our perspective, it seems to us that one of the major roles for technology is not to deliver pre-digested information to individuals, but to provide the opportunity and the resources for social debate and discussion. Technology can circulate stories, add annotations, and carry responses. Or, in simulations like SimCity, or the recently released SimHealth, it can help to develop scenarios, pursue entailments, and fashion alternatives.

Two terms have repeatedly come up in the course our discussion, sometimes in tandem and sometimes in tension, and sometimes in both. These are *informed* and *participation*. For us, these two are inseparable. To participate fully you must be fully informed, and to be fully informed, you must participate. The two cannot be taken apart. If you diminish one, you diminish the other.

There are several reasons why we have found this pairing useful in pursuing the relationship between technology and democracy. First, it narrows (if only a little) the extremely broad subject of "democracy." Second, it does not necessarily distinguish between democracy in the workplace or in society at large. Both require informed participation. And third, it brings democracy and technology into the same arena. Information technologies in particular are capable of supporting both informing and participating. Nonetheless, as we noted, they are not inherently democratic or empowering. Deskilling technology in the workplace, for example, has shown that technology can at times be fundamentally disempowering. And as our first scenario suggests, the wrong technological solutions in design for democracy—solutions that misunderstand what it is to be informed or to participate—could as easily disempower citizens.

We are confident that technology that genuinely supports informed participation will be inherently democratic, and adaptable. It will allow us to take advantage of our social diversity and not force us to conform to the limits of our limited foresight. Unlike the British parliament buildings, it will respond to change rather than constrain it.

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APPENDIX C: Communications and Society Program Statement

The Aspen Institute's Communications and Society Program seeks to advance communications and information policy-making to the greatest benefit of society. The specific purposes of the Program are (1) to provide a neutral forum for divergent stakeholders to assess the impact of the communications and information revolutions on democratic institutions and values, (2) to help bring about integrated, thoughtful, value-based decision-making in the communications and information policy fields to cope with problems and challenges of the late 20th century and beyond, and (3) to offer, when appropriate, recommendations of policies and actions at local, state, national, and international levels. The specific issues that the Program seeks to explore in 1994 fall into the four categories listed below: communications policy-making, communications for social benefit, communications and education, and communications for global understanding. The subject areas are not mutually exclusive. Recent and future project titles are listed below:

1. COMMUNICATIONS POLICY
   - Democracy in the Information Age (annual subscription seminar)
   - Annual Conference on Telecommunications Policy
     - 1994 – Business Alliances and Strategic Positioning— Implications for Stakeholders and Public Policy
     - 1993 – Local Competition: Options for Action
   - Computer Research Policy Summit (1992)
   - Aspen Communications Counsel's Forum
     - 1994 – Reformulating the Communications Act

2. SOCIETAL IMPACT OF THE INFORMATION INFRASTRUCTURE
   - The Aspen Forum on Communications and Society (FOCAS) (1994)
   - Television for the 21st Century: A Question of Equity (1994)
   - Annual Roundtable on Information Technology
     - 1994 – Assessing the Environment for an International Information Infrastructure
     - 1993 – The Promise and Perils of Emerging Information Technologies
     - 1992 – The Information Evolution: How New Information Technologies are Spurring Complex Patterns of Change
   - An Information Bill of Rights and Responsibilities (1993)
   - Toward a Democratic Design for Electronic Town Meetings (1992)
   - Assessing the Public Broadcasting Needs of Minority and Diverse Audiences (1992)
   - Television for the 21st Century: The Next Wave (1992)
   - SeniorNet Services: Towards a New Environment for Seniors (1991)

3. COMMUNICATIONS AND EDUCATION
   - Media Literacy: A Report of the National Leadership Conference on Media Literacy (1992)
   - Defining Education's Role in Telecommunications Policy (1991)
   - Telecommunications as a Tool for Educational Reform: Implementing the NCTM Mathematics Standards (1991)

4. COMMUNICATIONS FOR GLOBAL UNDERSTANDING
   - New Economic Relationships Arising from Democratization, Privatization, and New Technologies: Models and Options for the Commission on Television and Radio Policy (1993)
   - Television News Coverage of Minorities: Models and Options for the Commission on Television Policy (1992)
   - Television and Elections (1992)

The Aspen Cube: A Three-Dimensional Roadmap for Communications Policy Issues

The field covered by The Aspen Institute's Communications and Society Program is vast, but the many issues it covers can be defined and interconnected by means of a three-dimensional matrix, a kind of Rubik's Cube of the Information Age. Along one axis are characteristic trends of the Information Age, which will vary:

Digitization, Convergence, and Compression
Commodification of Information, Competition and Concentration
Virtuality; Networking and Simulation
Disintermediation and Fragmentation
Interactivity and User Control

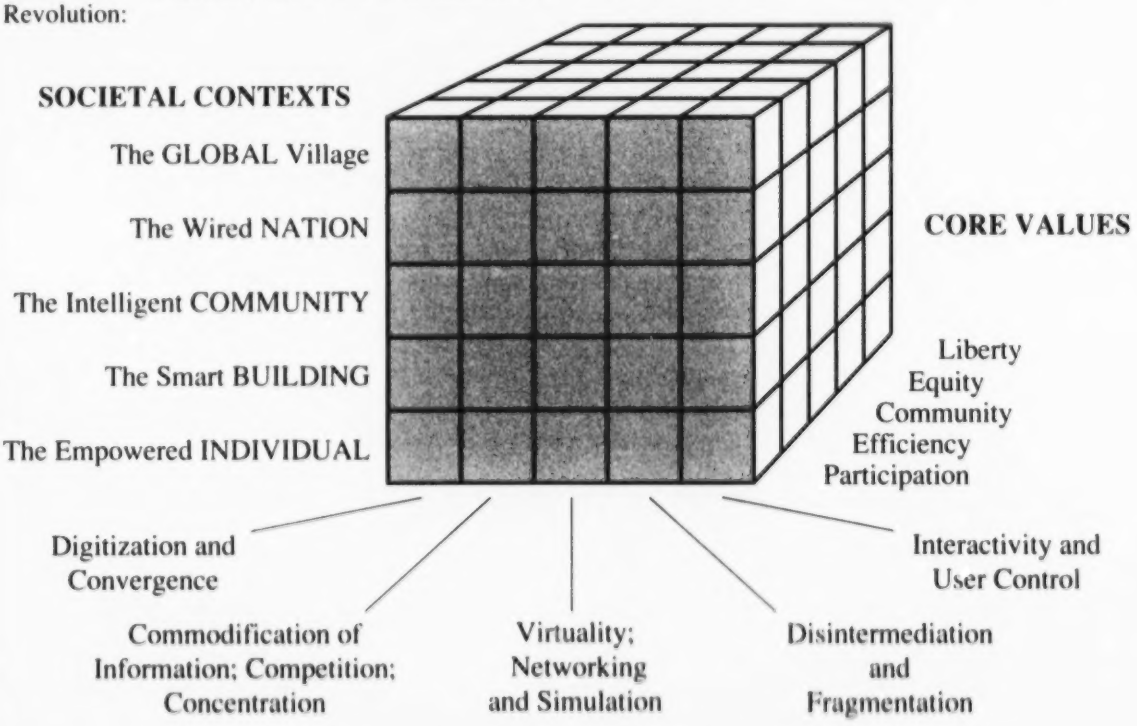
Across another side of the matrix are the societal contexts in which one should view the issues, viz., international; national; community; home, school, or office; and the individual. We use labels that have entered the vocabulary from the Communications Revolution:

The Global Village	*The Wired Nation*	*The Intelligent Community*	*The Smart Building*	*The Empowered Individual*

The third side of the cube lists the values that are most associated by the new communications media, structures, and institutions. This list, too, can vary. Our present approach looks at:

Liberty (including Privacy and Free Speech)
Equity (including Universality and Equality)
Community (including Diversity and Quality of Life)
Efficiency (including Productivity)
Participation (including Access)

This construct can be pictured as a cubic matrix. From any particular point or cube within the matrix, one can move along any or all of the three axes, connecting technological trends, strata of society, and values.



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